



# MODELED OR PLANNED v. AS-BUILT - IN PERIODS

Understanding the differences between the more frequently used delay analysis methodologies

**John H. McTyre, Partner, Americas, HKA**

A forensic delay analysis should at least produce the following:

- Identification of activities that actually caused delay to the critical path; and
- Quantification of critical delay caused by each activity.

In theory, the “actual” amount of critical delay caused by an activity should be an objective endeavor. However, as most of us are aware, consultants on opposing sides of a dispute will usually (always) arrive at vastly different conclusions regarding the activities that caused delay and the amount of delay caused by each. Part of the difference is often in the selection of a method of analysis.

A consultant can use any methodology when presenting a forensic delay analysis, but some are more robust than others. Understanding this is key to evaluating delay analyses prepared by others and calling out their “errors”.

For purposes of this narrative, I will focus on the most widely used methods of delay analysis:

1. Impacted As-Planned<sup>1</sup>
2. Time Impact Analysis
3. Planned v. As-Built.

In order to avoid confusion regarding the nomenclature this narrative defines the three methodologies as follows:

## 1 > **Impacted As-Planned (IAP):**

An analysis that uses the IAP methodology consists of inserting “fragnets” in the planned project schedule (baseline) to measure the change to the completion date.

A fragnet is a network of one or more activities that represents a change or other impact that was not part of the planned project schedule.

The planned project schedule, often referred to as the baseline schedule, is the schedule that includes all the work of the original contract (without change orders). For the analysis, it is preferable to use an approved baseline schedule, and if not formally approved, the schedule that was used by the parties contemporaneously.

This method of analysis concludes that if after inserting the fragnet (or multiple fragnets inserted in chronological order) into the baseline schedule the completion date is delayed (can only be later), then the cause of that delay was the change represented by the fragnet(s).

**A CONSULTANT CAN USE ANY METHODOLOGY WHEN PRESENTING A FORENSIC DELAY ANALYSIS, BUT SOME ARE MORE ROBUST THAN OTHERS. UNDERSTANDING THIS IS KEY TO EVALUATING DELAY ANALYSES PREPARED BY OTHERS AND CALLING OUT THEIR “ERRORS”.**

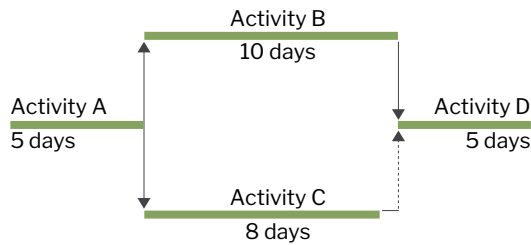
<sup>1</sup> Impacted as Planned is used extensively in Latin America.

2> **Time Impact Analysis (TIA):**

The principal difference between the TIA and the IAP is that in the TIA, the fragnet is inserted in a project schedule update – preferably one closest to the actual date of the change represented by the fragnet. As in the case of the IAP, if the project completion date changes (becomes later) after insertion of the fragnet, then it is concluded that the change or impact represented by the fragnet was the cause of the delay.

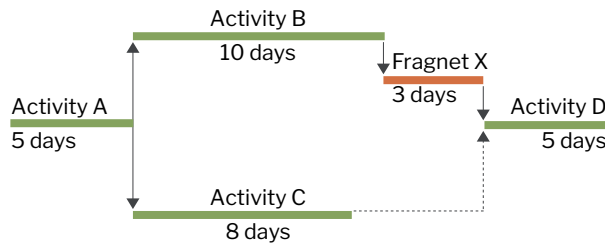
A very simple example of the application of the TIA/IAP is as follows:

**Baseline/Update:**



In this example above: the baseline/update schedule has a critical path through activities A, B and D and a project duration of 20 days.

Fragnet Insertion: Fragnet X (3 days) represents a change that was performed after Activity B and before Activity D.



Based on this simple example, the completion date has been delayed 3 days. The cause of the delay is the change or impact represented by Fragnet X.

3> **Planned v. As-Built – in Periods (PAB):**

The PAB method of analysis compares the planned performance to the actual or as-built performance evaluating each impact to the critical path (critical path being a dynamic/evolving condition) in a chronological and cumulative manner. Again, it is preferable to start with an approved schedule, but if a formally approved schedule is not available, then the plan used for construction should be used. The as-built data can usually be obtained by any combination of schedule updates, daily/weekly reports or correspondence.

When there are significant changes in the planned performance, the analysis should be divided into periods (often referred to as windows) such that the actual performance is compared to the contemporaneous plan. Generally each period will commence with an approved schedule update (if not approved then one that was used for construction) that includes the changed plan.

There are variations of the methods described above.

**AACEI RECOMMENDED PRACTICE NO. 29R-03, FORENSIC SCHEDULE ANALYSIS (RP 29R-03):**

RP 29R-03 separates the retrospective delay analysis methodologies into two categories: Observational and Modeled (Additive and Subtractive). The Observational methods are variations of the PAB and the Modeled Additive methods are variations of the IAP and the TIA. The Modeled Subtractive method is not used as frequently as the methods addressed herein.

The RP 29R-03 does not recommend the use of one method over another, it describes the different methods.

**SOCIETY OF CONSTRUCTION LAW (SCL) DELAY AND DISRUPTION PROTOCOL - 2ND EDITION (SCL PROTOCOL):**

The SCL Protocol identifies six methods of analysis. The three addressed herein are identified and described in the SCL Protocol.

In a departure from the 1st edition of the SCL Protocol, the current version does not recommend a particular method over the others for forensic analysis.

**ISSUES WITH MODELED METHODS (IAP AND TIA):**

There are two areas where modeled methods of analysis can produce results that are inconsistent with the actual critical delay:

1. Status at the time of impact - differences between actual and planned performance in the period between the data date of either the baseline or the update that the fragnet was inserted into and the start of the fragnet, and;
2. The progress during the actual performance of the fragnet.

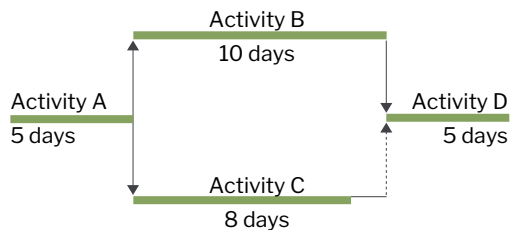
1> **Status at the time of the impact:**

In the delay analysis, even if the model or fragnet is an accurate representation of the actual change, the IAP or TIA will produce inaccurate results if the status of construction at the start of the fragnet is not considered. In the time elapsed between the data date of the baseline/update and the start of the fragnet construction may not have progressed precisely as forecast in the baseline/update.

The RP 29R-03 partially recognizes this deficiency when it states that the “[a]ccuracy of the duration of critical path impact for any given delay event degrades in proportion to the chronological distance of the delayed event from the data date of the schedule”. Not only does the “accuracy of the duration” of the impact “degrade”, the method could also be ascribing critical delay to an activity that is not critical at the time of the delayed event.

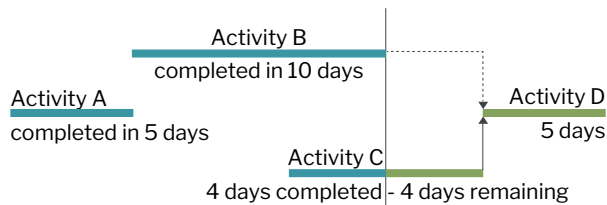
As an example, consider the simple application of the IAP or TIA used previously:

**Baseline/Update:**

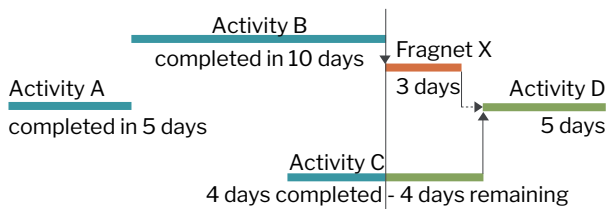


Consider the impact of the fragnet if all work was performed as planned except that Activity C started 6 days late:

**Status on day 15:**



Insertion of Fragnet X would have no impact on the completion date:



The critical delay, in this case, would be 4 days due to the 6-day delay in the start of Activity C (2 days were float).

Fragnet X has no impact, it just consumes float that was created by the delay in the start of Activity C.

In a recent ICC Arbitration, a schedule consultant presented an IAP analysis that involved the replacement of a major piece of equipment in a functioning plant (one of several milestones). Because the plant was functioning it was in the interest of the owner to minimize the downtime (from the shutdown of the existing to the start-up of the new). Field activities were scheduled to start in June which included foundations, other civil works and preliminary mechanical activities that were to be completed before the scheduled shutdown of the existing piece of equipment in November. In the analysis, the fragnet for the actual shutdown of the existing equipment was inserted into the original schedule (Data Date May) with a start date in May of the following year, resulting in a critical delay of approximately 6 months (November to May). The 6-month delay was attributed to the owner for delaying the start of the shutdown.

What the analysis failed to address was the status of the preliminary field activities. As it turns out, the owner had agreed, the month before, in April, to commence the shutdown in May because the April schedule update projected that the preliminary works would be completed in May. The updates had continuously shown the preliminary works slipping (with no indication that the owner had caused any delay).

The owner did not cause the critical delay – certainly not 6 months. However, the obfuscation created by the consultant’s report describing/defending the IAP methodology with computer printouts showing the models could mislead the arbitrators. The message to the arbitrators was that the sophisticated scheduling software using an AACeI “Recommended Practice” methodology concluded that the owner caused the 6-month delay.

The application of the methodology was not wrong but the results were misleading relative to what actually occurred. The problem with both the IAP and the TIA is that neither address what occurs between the data date and the start of the fragnet (model).

**2> The progress during the actual performance of the fragnet**

In retrospective analyses, the as-built data should exist. If the as-built data exists, then what is the purpose of creating a model?

This is analogous to a typical extra work situation wherein a contractor submits a proposal for the cost of extra work before the work is performed that is, for example, based on 10 workers for 10 days. It can be said that the proposal is an estimate or “model” of what the contractor expects the change will require. If the owner accepts that proposal and a change order is executed, then it does not matter if the actual work required 8 workers for 8 days or 12 workers for 12 days – the executed change order will apply.

On the other hand, if there was not an agreement then after the work was actually completed, it makes no sense to either revert back to the proposal or to create a model. If the actual data is known, then the actual number of workers and the time they actually worked on the change should be used for the cost of the change and the time.

If a change or impact has occurred, then there is no reason to resort to models or fragnets rather than the as-built data.

**ISSUES WITH THE OBSERVATIONAL METHOD (PAB):**

The principal issue with the PAB method of analysis is that it is generally more time consuming than the modeled methods. The more detail provided in the analysis of the as-built data the more precise the conclusions.



JOHN HAS OVER 25 YEARS' EXPERIENCE PREPARING AND ANALYZING CONSTRUCTION CLAIMS. HIS EXPERIENCE SPANS BUILDINGS, INFRASTRUCTURE, MINING, OIL AND GAS, AND POWER AND UTILITIES. JOHN HAS TESTIFIED AS AN EXPERT ON MATTERS RELATED TO CONSTRUCTION IN BOTH ENGLISH AND SPANISH.

## RECOMMENDATIONS

The SCL Protocol describes the TIA (fragnet analysis) as the “recommended procedure” to be followed for “contemporaneous analysis of delay”. However, neither the SCL protocol nor the AACEi recommend the TIA as a preferred method in forensic situations. The SCL Protocol indicates “after the completion of the Works” the TIA “may no longer be appropriate”. AACEi RP 52R-06 states that the TIA “is not recommended for a retrospective (hindsight or forensic) view”.

Two areas of concern when using the modeled methods are:

1. differences between actual and planned performances in the period between the data date of either the baseline or the update that the fragnet was inserted into and the start of the fragnet, and;
2. the progress during the actual performance of the fragnet.

The remedy to the first concern is to simply consider the actual progress of the work and changes in the plan from the data date to the start of the fragnet. Without considering the actual progress (as-built) and the changes in the plan, conclusions regarding actual critical delay can be wrong.

With regard to the second concern, the model, or fragnet should use the actual data and it should be compared to the actual data of the remainder of the activities in progress contemporaneously. The actual data should be available in a forensic analysis.

If the way to address the principle deficiencies with the two modeled methods, the IAP and the TIA, is to consider using the actual or as-built data both before and during the period of the fragnet, then consider using the PAB method.

The increased accuracy of the PAB will usually justify the extra time required relative to the modeled methods.

Provided that as-built data is used to supplement the IAP and TIA, any of the three methods: IAP, TIA or PAB will;

- Identify the activities that actually caused delay to the critical path
- Quantify the critical delay caused by each activity.

## ABOUT THE AUTHOR

**John H. McTyre** has more than 35 years of experience in construction.

More than 10 years were on-site assignments serving in various positions including Assistant Superintendent, Project Manager, and Owner's Representative. He has spent more than 25 years preparing and analyzing construction claims including delay quantification; delay damages; loss of efficiency, and extra work entitlement.

Representative projects include power generating facilities; oil sands; gold/copper mines; liquefied natural gas facilities; pipelines; airports; road/highways; refineries; stadiums; light rail; hospitals; courthouses; educational facilities, and sewer treatment facilities.

Clients include owners; contractors; subcontractors; federal/ state governments; and design firms. Mr. McTyre has testified as an expert in various venues on matters related to construction (in English and Spanish).